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DETERMINING THE AGE OF BLISTER RUST INFECTION ON SUGAR PINE

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Early investigations of white pine blister rust in the Pacific Northwest provided a large basis of infection data, from which Lachmund 1/ devised a method to postdate infections on western white pine. He found that rust cankers originating in a single year were consistently distributed in a characteristic pattern on the pine trees -- most of the cankers were to be found on wood grown in the year before the time of infection. A recent test shows that his findings also apply to sugar pine in California and Oregon.

Lachmund designated the pine growth of the year of infection as "a," the adjoining interwhorl 2/ of the previous year's growth as "b," the third youngest interwhorl as "c," and so forth. When cankers were tallied by interwhorls, more than half the cankers originating in a given year were on the "b," interwhorl (table 1). The "a" growth could then be identified, and since this was the youngest interwhorl infected that year, the age of the "a" interwhorl was taken as the age of the infection wave tallied.

Lachmund's method of determining the age of rust infection has been used by blister rust workers in southern Oregon and northern California to determine the age of infection on sugar pines. General observations in southern Oregon indicated that the pattern of canker distribution was

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1/ Lachmund, H. G. Method of determining age of blister rust infection on western white pine. Jour. Agr. Research 46:675-693, illus. April 1933.

2/ In conifers, the lengths of stem between branch whorls have often been referred to in past literature as internodes, a usage botanically incorrect. The term "interwhorl" is not open to this objection.

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similar on sugar pine to the pattern Lachmund determined for western white pine. Recently some workers in California have noticed a seemingly different pattern on sugar pine. For this reason there has been some doubt as to the accuracy of age determinations of infection on sugar pine based on Lachmund's pattern.

To determine the pattern of canker distribution on sugar pine, and the applicability of Lachmund's pattern in determining the year of infection on this pine species, analysis of canker distribution from infection of known age has been made from data on plots designed primarily to study the spread of blister rust. Records of infections occurring in a single season on four sugar pine plots in Oregon and two in California were used in this analysis.

The tallies for the four Oregon plots give patterns approximately the same as for western white pine (table 1). On the California plots the percentage of cankers originating on the "a" interwhorls of sugar pine was approximately twice that for western white pine. In either case, however, the general patterns for sugar pine were quite similar to that for western white pine, a major part of the cankers developing on "b" interwhorls. Any of the six tallies made from the sugar pine plots leaves no doubt as to the year of infection when Lachmund's method is applied. The correct age of infection was denoted by a tally of only 10 cankers on Black Rock Plot 3.

The relatively late date when pine infection occurred at Big Bar in California may account, at least in part, for the greater percentage of the cankers originating on "a" growth as compared to the Oregon plots. Rains providing moisture conditions suitable for pine infection normally occur later in the fall in the Sierra Nevada than at locations further north. By that time in the season the new needles developed on sugar pines during the year are physiologically nearly mature; they more nearly approach the condition of second year, or "b" needles than that of first-year needles at more northerly locations. Accordingly, the first-year needles at Sierran locations could be expected to be more receptive to the rust than those at the northerly end of the sugar pine range or in the commercial range of western white pine. The analysis of plot results reported here supports this inference.

Table 1. Distribution of blister rust cankers, originating in a single year, on the five youngest interwhorls, i.e., "a" year of origin, "b" previous year, "c" third youngest, et cetera.

Pine species and location	Percent of cankers originating on					No. of cankers used as basis
	a	b	c	d	e	
WESTERN WHITE PINE						
Lachmund's studies in the Pacific Northwest	9.8	53.2	31.3	5.2	0.5	5,879
SUGAR PINE						
California						
Plumas N.F.						
Big Bar Plot 1	19.1	40.4	31.9	8.5	0.0	47
Big Bar Plot 4	20.8	49.2	26.5	3.2	0.3	1,132
Oregon						
Deschutes N.F.						
Black Rock Plot 1	10.3	55.2	24.1	10.3	0.0	29
Black Rock Plot 2	4.8	45.2	35.7	9.5	4.8	42
Black Rock Plot 3	20.0	40.0	40.0	0.0	0.0	10
Black Rock Plot 4	5.9	41.2	23.5	29.4	0.0	17
All Oregon Plots	8.2	46.9	30.6	12.3	2.0	98
All Sugar Pine	19.8	48.7	27.0	4.1	0.4	1,277

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